Contract No. 68-W-98-210

RAC II

Remedial Response, Enforcement Oversight and Non-time Critical Removal Activities at Sites of Release or Threatened Release of Hazardous Substances in EPA Region II

CDM

in association with TAMS

401121

ADDENDUM TO
DRAFT FINAL FEASIBILITY STUDY REPORT
OPERABLE UNIT 3
GROUNDWATER, SURFACE WATER AND SEDIMENT
REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)
FEDERAL CREOSOTE SUPERFUND SITE
MANVILLE, NEW JERSEY
Work Assignment No.: 001-RICO-02JJ

Prepared for
U S Environmental Protection Agency
290 Broadway
New York, New York 10007-1866

Prepared by
CDM Federal Programs Corporation
125 Maiden Lane - 5th Floor
New York, New York 10038

EPA Work Assignment No	001-RICO-02JJ
EPA Region	II
Contract No	68-W-98-210
CDM Federal Programs Corporation DCN	3220-001-RT-FEAS-03253
Prepared by	CDM Federal Program Corporation
Site Manager	Frank Tsang
Telephone Number	(212) 785-9123
EPA Remedial Project Manager	Mark Austin
Telephone Number	(212) 637-3954
Date Prepared	June 28, 2002

401122

CDM

125 Maiden Lane 5th Floor
New York, New York 10038
tel 212 785 9123
fax 212 785-6114

June 28, 2002

Mr Mark Austin
Remedial Project Manager
U S Environmental Protection Agency
290 Broadway - 19th Floor
New York, NY 10007-1866

PROJECT	RAC II Contract No . 68-W-98-210 Work Assignment No 001-RICO-02JJ
DOC CONTROL NO	3220-001-RT-FEAS-03253
SUBJECT	Addendum to Feasibility Study Report for OU3 Groundwater, Surface Water and Sediment Federal Creosote Superfund Site Remedial Investigation/Feasibility Study (RI/FS) Manville, New Jersey

Dear Mr Austin

CDM Federal Programs Corporation (CDM Federal), on behalf of our entire RAC II Team, is pleased to submit ten copies of the Addendum to Draft Final Feasibility Study Report for Operable Unit 3 of the Federal Creosote Superfund Site in Manville, New Jersey as fulfillment of Subtask No 13 of the Statement of Work Please note that copies have been sent to NJDEP under separate cover

If you have any questions regarding this submittal, please contact me or Frank Tsang at your earliest convenience at (212) 785-9123

Sincerely,

CDM FEDERAL PROGRAMS CORPORATION

Jeanne Litwin, REM
Technical Operation Manager

cc D Butler, USEPA (letter only)
H. Eng, USEPA (letter only)
M Dolly, USACE (2 copies)
D Sites, NJDEP (4 copies)
F Tsang, CDM Federal
R Goltz, PSO File - CDM Federal
K Tan, CDM Federal
RAC Document Control

401123

Addendum to
Draft Final Feasibility Study Report for
OU3 Groundwater, Surface Water and Sediment
Federal Creosote Superfund Site
Manville, New Jersey

1.0 PURPOSE

The purpose of this Addendum to the Draft Final Feasibility Study Report for Operable Unit 3 (OU3)-Groundwater Surface Water and Sediment for the Federal Creosote Superfund Site is to provide justifications for the technical impracticability (TI) of remediating the contaminated groundwater at the site EPA has proposed long-term monitoring and institutional controls as the remedy for groundwater at the site This addendum supplements Section 6 2 2 of the FS report (Copies of cited figures and tables from the FS report are attached to this addendum)

The TI justification is based on the fact that dense non-aqueous liquids (DNAPL) were found in fractured bedrock at this site, and based on remedial experience at other, similar Superfund sites contaminated with DNAPL, it would not be technically feasible to completely remove creosote from the groundwater at this site As a result, chemical-specific ARARs, i e , MCLs for PAHs and other creosote related compounds, would not be met by the proposed remedies Therefore, a TI determination is sought for all creosote-related compounds in the site groundwater

2.0 BACKGROUND

The Federal Creosote Superfund Site in Manville, New Jersey, consists of a residential area known as the Claremont Development and a commercial area known as the Rustic Mall The former Federal Creosote wood treatment facility operated at this site from 1910's to 1950's While in operation, creosote wastes were discharged into two unlined lagoons via two canals As a result, creosote wastes seeped into the subsurface soil and fractured bedrock from the canals and lagoons The creosote wastes in the subsurface soil and fractured bedrock acted as source materials and contaminated the surrounding groundwater in the overburden aquifer and the bedrock aquifer

The former Federal Creosote wood treatment facility pressure-treated wood using coal tar creosote Creosote is a complex mixture of materials consisting of over 250 compounds Coal tar creosote consists of three major classes of compounds Approximately 85 percent of the mixture is made up of polycyclic aromatic hydrocarbons (PAHs), approximately 10 percent is phenolic compounds, and the remaining portion of the mixture consists of heterocyclic compounds

The Remedial Investigation (RI) demonstrated free product creosote in the form of DNAPL, which originated from Lagoon A, in the bedrock aquifer Product was noted at 69 feet below ground surface (BGS) in the rock core for monitoring well MW-116I and at 120 feet BGS in the boring for monitoring well MW-2D The DNAPL has migrated downward, under the influence of gravity, and laterally, to the northwest, along bedding planes to the location of MW-116I, which is located 180 feet northwest of Lagoon A, offsite, in the Wal-Mart parking lot The DNAPL has also moved downward under the influence of gravity from Lagoon A to MW-2D, which is located north of and immediately adjacent to Lagoon A

Creosote DNAPL, which originated from Lagoon B, was observed in intermediate bedrock monitoring well MW-5I The total depth of this well is 55 feet BGS The DNAPL has apparently migrated downward under the influence of gravity and laterally, along strike, to the northeast, to the location of MW-5I Monitoring well MW-5I is located on-site and is approximately 150 feet northeast of Lagoon B Figures 1-13 and 1-14 of the FS report depict the well locations

Semivolatile organic compounds (SVOCs) were the most commonly detected organic compounds in the overburden aquifer groundwater samples Table 2-5 from the FS report summarizes the sample results and compares them to the screening criteria Detections of SVOCs in groundwater samples from the shallow aquifer zone were limited to wells immediately adjacent to the primary creosote source areas SVOCs do not appear in groundwater samples from downgradient wells above screening criteria In general, the PAHs were detected at high concentrations in groundwater beneath Lagoons A and B where free-phase creosote product was observed Naphthalene, the primary indicator compound for site-groundwater contamination, was detected above the screening criteria in groundwater samples in the immediate vicinity of the Lagoon A and B areas The naphthalene results, and the PAH results in general, indicate shallow groundwater contamination is limited to the primary creosote source areas at the site Figure 1-13 of the FS report depicts contamination by naphthalene and selected compounds in the shallow aquifer

SVOCs were the most commonly detected organic compounds in the intermediate and deep wells The sample results and their comparison to the screening criteria are presented in Table 2-5 of the FS report Naphthalene, the primary indicator compound for site-groundwater contamination, was detected above its criterion in groundwater samples from five on-site wells four on the northern portion of the site, close to Lagoon A, and one just east of Lagoon B Naphthalene exceeded its New Jersey Groundwater Quality Standards (NJGQS) criterion in a sample from one off-site well (MW-116I), where DNAPL was also observed None of the remaining off-site well samples, including the two municipal production wells (C1 and C2) had detections of naphthalene Dibenzofuran, phenanthrene, and carbazole were detected above screening criteria in samples from the same six monitoring wells where naphthalene was found above its criterion Figure 1-14 of the FS report shows the analytical results for naphthalene and selected compounds in the bedrock aquifer

The Federal Creosote Site and neighboring impacted off-site areas have been divided into three operable units (OUs) OU1 includes the creosote source contamination at the former lagoons, canals, and lagoon exit trenches, which are found within the Claremont Development Included in OU2 are the surface and subsurface soil of the Claremont Development, excluding OU1 materials OU3 includes surface and subsurface soil at the Rustic Mall, groundwater (onsite and offsite), surface water and sediments EPA signed Records of Decision for both OU1 and OU2, which called for the excavation of source materials and contaminated soil The remediation involves the excavation of contaminated soil and free-phase creosote from the overburden down to bedrock The excavation also involves dewatering the lagoon areas down to bedrock

3.0 ARARS AND CLEANUP CRITERIA

Both Federal and State chemical-specific ARARs were identified in Section 2 2 1 of the FS report for groundwater New Jersey groundwater regulations are considered to be applicable in the remediation of groundwater contamination at Federal Creosote Federal and State primary drinking water regulations are considered to be relevant and appropriate for consideration in the remediation of the groundwater While the site groundwater represents a potential future source of potable water, groundwater in the vicinity of Federal Creosote is not currently used as a source of potable water

Preliminary Remediation Goals (PRGs) for groundwater contaminants of potential concern (COPCs), as related to creosote contamination, are identified in Table 2-5 of the FS report and are derived from the stricter of the applicable federal or state chemical-specific ARARs Site-specific risk-based criteria were not used to develop the PRGs for groundwater since promulgated standards exist for the COPCs These PRGs for the COPCs provide the basis for complying with the ARARs for groundwater described above As depicted in Table 2-5 of the FS report, naphthalene was the most frequently detected compound with the highest observed concentrations Benzene, 2-methylnaphthalene, carbazole, dibenzofuran and phenanthrene were also detected in the groundwater plume with slightly less frequency and at lower concentrations All these compounds are susceptible to biodegradation The high molecular weight PAHs, e g , benzo (a) pyrene, were detected infrequently and with concentrations only slightly above the PRGs These high molecular weight PAHs are refractory to biodegradation but are also immobile because of their extremely high sorption coefficient (Koc), which is defined as the ratio of adsorbed chemical per unit weight of organic carbon to the aqueous solute concentration This value provides an indication of the tendency of a chemical to partition between particles containing organic carbon and water

4.0 CONCEPTUAL MODEL

To formulate a remedy for the site, a conceptual model of the site was developed and is depicted in Figure 1-11 of the FS report

The Federal Creosote site is located on a topographic high within the Raritan River watershed system The Raritan River passes approximately 2,000 feet north and east of the site, and the Millstone River, a tributary of the Raritan, is located approximately 1,200 feet to the southeast The confluence of the two rivers lies approximately one mile east of the site. From the topographic survey performed for the project, it is apparent the site is situated at a topographic high The site is immediately bounded on the north by the Norfolk Southern Railroad and to the south and east by tracks of the CSX Railroad, which intersect northeast of the site These rail lines have been in existence and active for more than a century Drainage patterns at, and near, the site may have been altered by the railroads, although the extent of the impact is not known

At the northern edge of the site and immediately to the northwest, the greatest elevations in the area are encountered The lowest portions of the site are found to the south and southwest Storm sewers at the site divert stormwater offsite to the Millstone River via culverts and the Pulaski and Koscucko Street outfalls to the east

The site RI included investigation of both the overburden and the bedrock geology The surficial unconsolidated overburden deposits in the site's vicinity are of glacial, interglacial, and post-glacial fluvial origin Regionally, these deposits consist of sand and pebble gravel, with minor silt, clay and cobbles Total thicknesses of this unit in the area of the site is 25 to 35 feet of unconsolidated sediments of glacio-fluvial origin

Underlying the overburden deposits is a thick succession of Late Triassic siltstone and shale of the Passaic Formation. This bedrock consists of reddish-brown lacustrine siltstone, mudstone, shale and occasional sandstone of fluvial origin The Passaic Formation is the thickest and most widespread formation in the Newark Basin, with an estimated thickness of 9,000 feet in the vicinity of the site

The soil boring lithologic descriptions suggest the following sequence (from the ground surface to the bedrock surface) of deposits to be typical at the site

- Fill
- Sand and Gravel
- Silt and Clay
- Sand and Gravel (with some silt and clay layers and seams)
- Weathered siltstone and shale (bedrock)

The hydrogeology at the site is subdivided as two hydrostratigraphic zones, the overburden and the bedrock aquifer, which are separated by a weathered bedrock zone of lower permeability

Groundwater in the overburden exists under both unconfined and semi-confined conditions The water table is found at approximately 20 feet BGS, however, shallow discontinuous silt and clay layers may cause isolated perched watertable conditions Beneath the site, the groundwater flow in the overburden is predominantly towards the southeast and the Millstone River Downward hydraulic gradients dominate the majority of the site Figures 1-7 and 1-8 of the FS report show the overburden groundwater elevation contour diagrams for this site

The bedrock aquifer is a complex "leaky" multi-unit, semi-confined, aquifer system in which groundwater flow paths are along bedding plane partings and high angle fractures The bedrock at the site is highly fractured and there is evidence of significant vertical flow The vertical gradients observed in the nested wells indicate that the shallow and deep aquifer zones are hydrologically connected The base of the bedrock aquifer is defined by a bedrock surface below which all fractures have been in-filled by gypsum and the bulk permeability is essentially zero As such, the thickness of the aquifer is defined by the elevation of the gypsum cement

Like the potentiometric surface for the overburden, the bedrock potentiometric surfaces indicate the groundwater flow direction beneath the site is to the southeast across the site (Figure 1-9 and 1-10 of the FS report) However, a divide is present in the northwestern portion of the study area, approximately one-half mile northwest of the Claremont Development Groundwater to the west/northwest of the divide flows northwest towards the Raritan River and the Manville municipal wells C1 and C2 Groundwater to the south of the divide flows to the east/southeast, across the site, towards the Millstone River Vertical flow data indicates downward groundwater flow near the divide and upward groundwater flow near the Millstone River

A generalized cross section was developed that incorporates both Lagoon A and Lagoon B (Figure 1-11) The cross section includes monitoring wells that contain accumulated free product In general, the flow of the creosote product is primarily determined by gravity The downward flow is retarded by the discontinuous silt and clay unit The product flows along, around and through breaks in this unit The creosote product is again retarded by the glacial till and the weathered bedrock immediately below it Once the creosote product reaches the bedrock, it flows down through a series of vertical fractures in the deeper bedrock The potential downward flow of the creosote is bounded by the gypsum infilling of the fractures, which effectively reduce the porosity and permeability of the bedrock to zero

In general, transmissivity increases across the study area from the northwest to the southeast, with the highest transmissivity observed on the southeast side of the site at location in the Lost Valley The lowest transmissivities appear to be associated with a high elevation of the gypsum in-filled surface (effectively reducing aquifer thickness) and relatively poor interconnection of fractures Conversely, the highest transmissivities in the Lost Valley may be evidence of more extensive fracturing and greater aquifer thickness in this area

In general, the hydraulic conductivities (K) increased with depth until the gypsum layer was reached and then it became effectively zero The hydraulic conductivity is greatest in the Lost Valley area, which also is the most highly fractured area According to packer tests the hydraulic conductivity in the bedrock aquifer ranges from 0 05 foot/day of MW-105 to 65 95 foot/day of MW-113 Results of slug tests show a range of hydraulic conductivity in the overburden aquifer from 0 6 foot/day at MW-12S to 87 9 feet/day at MW-114S

The remedial investigation results, as summarized in Section 1 of the FS report, indicated that creosote free-phase product in the form of DNAPL was detected in the overburden aquifer and in the fractured bedrock beneath Lagoons A and B The DNAPLs are either lying in the low areas on top of the bedrock surface, or trapped within bedrock fractures Some of the free-phase creosote detected appeared to have "aged" and had become more viscous than the regular creosote

Some low molecular weight PAHs (e g , naphthalene and 2-methylnaphthalene), carbazole, dibenzofuran, and benzene have dissolved in groundwater and were detected as aqueous plumes in the overburden and bedrock aquifers in the immediate areas around Lagoons A and B These low molecular weight compounds are soluble and are therefore mobile in groundwater These compounds are also easily biodegradable and have short half-lives The high molecular weight PAHs, e g , benzo(a)anthracene, benzo(a)pyrene, and benzo(k)fluoranthene, have high Koc and retardation factors, and as such, are not soluble in water and therefore are not mobile in groundwater These types of compounds are also refractory to biodegradation The following table summarizes the chemical properties and provides an overview of biodegradation and fate and transport for selected compounds found in the aqueous plume

Selected Compounds	Solubility (mg/L) [1]	Approx. Koc [1]	Retardation Factor [1]	Biodegradation and Fate and Transport [2]
Benzene (1 ring compound)	1800	16	1 1	Highly soluble in water and biodegrade easily in aerobic conditions Biodegradation half-life is short, several days in water
Naphthalene (2 ring compound)	30	1300	7	Moderately soluble in water Biodegrade easily, half-life is a couple of days to a few months
2-methyl naphthalene (2 ring compound)	25	8500	39	Will adsorb to sediment and particulate matter based on high Koc Biodegrade in a moderate rate
Dibenzofuran (3 ring compound)	10	10,000	46	Will strongly adsorb to sediment and particulate matter based on high Koc Can be biodegraded. Biodegradation may be slow, in particular when oxygen is limited
Phenanthrene (3 ring compound)	1	23,000	100	Will bind strongly to soil based on high Koc Biodegradation in water is expected
Carbazole (3 ring compound)	1 8	700	4 1	Very low solubility in water Biodegradation half-life from several minutes to several hours
Benzo(a) anthracene (4 ring compound)	0 012	1,400,000	6200	Biodegradation to occur in both soil and water, with a half-life in days Will strongly adsorb to sediment and particulate matter given its high Koc and retardation factor
Benzo(a)pyrene (5 ring compound)	0 0039	1,000,000	4,500	Will strongly adsorb to sediment and particulate matter given its high Koc and retardation factor Biodegradation to occur slowly in both soil and water, with a half-life in months to years
Benzo(k) fluoranthene (5 ring compound)	0 00055	4,400,000	19,000	Will strongly adsorb to sediment and particulate matter given its high Koc and retardation factor Biodegradation to occur slowly in soil, with a half-life in months to years

Sources
(1) From Table 5-1 of the Remedial Investigation Report for the Federal Creosote Site
(2) From hhtp //toxnet nlm.nih gov/cgi-bin/sis/search/ Additional information is included in Appendix B

The aqueous plume has not migrated far from the source areas (Lagoons A & B) and is not expected to migrate much further especially after the source areas in the overburden are remediated under OU1 Estimation of contaminant migration rates for naphthalene and benzene in groundwater strongly suggests that natural attenuation processes are important for degrading site-related contaminants and impeding the migration of these contaminants Specifically, using site values for hydraulic conductivity (k=14 2 ft/day in overburden and 2 19 ft/day in bedrock) and hydraulic gradient (i=0 002 in both aquifers), and literature values for effective porosity (n=0 25 in overburden and 0 01 in bedrock) and a retardation factor of 6 7, naphthalene would have traveled 550 feet in the overburden and 2,150 feet in the bedrock over the 90 years since creosote was released into the environment Likewise, benzene with retardation factor of 1 1 would have traveled 3,300 feet in the overburden and 13,000 feet in the bedrock if no natural attenuation processes were occurring The RI report indicates that both naphthalene and benzene plumes are found within 250 feet of Lagoons A and B in both aquifers The limited movement of the dissolved naphthalene and benzene is strong evidence that these contaminants are naturally degrading in both aquifers Another body of evidence supporting active natural attenuation process is the concentrations of naturally occurring metals in the creosote source areas Elevated concentrations of iron and manganese, which are often indicators of natural biodegradation processes, are especially high in the areas where elevated concentrations of naphthalene occur, particularly in the overburden

5.0 SPATIAL AREA OVER WHICH TI WAIVER APPLIED

The area for which the TI waiver is proposed covers approximately 119 acres, as depicted in Figure 1 The area includes three distinct subareas the north off-site subarea, the on-site subarea, and the south off-site subarea The north off-site subarea encompasses the southwestern portion of the Wal-Mart shopping center (Block 311, Lot 1), and a portion of the Norfolk-Southern Railroad Right-of-Way (Block 313) This subarea covers approximately 35 acres It is bounded to the west by North Main Street, to the south by the Claremont Development/Rustic Mall, and to the east by MW4D The on-site subarea consists of the Claremont Development, which includes Blocks 314, 215, 316, 317, and 318, Rustic Mall, which includes Blocks 310 and 310 01, and a portion of the triangle between the two railroad rights-of-way (Block 310, Lot 1) This subarea is bound to the west by South Main Street, to the north by Block 313, to the south and east by Block 281 and East Camplain Road It covers approximately 57 acres The south off-site subarea encompasses a portion of the CSX Railroad Right-of-Way (Block 281), and Blocks 173, 175, 176, 181, and 182, and a portion of Block 180 This subarea is bound to the northwest by the Claremont Development, to the southwest by South Park Street, to the south by Huff Avenue, and to the northeast by a line connecting Liberty Street with MW4D It covers an area of approximately 27 acres

The TI waiver should include both the overburden aquifer and the bedrock aquifer within the area Because the remediation under OU1 and OU2 are on going, the quantity of residual contamination is not known This area may be reduced if the monitoring results confirm that the OU1 and OU2 remedy has successfully removed a substantial quantity of DNAPLs from the overburden aquifer

6.0 EVALUATION OF RESTORATION POTENTIAL

6.1 CONTAINMENT AND REMOVAL OF CONTAMINATION SOURCES TO THE EXTENT PRACTICABLE

For DNAPL sites, EPA guidance (EPA, 1996b) considers DNAPLs as a principal threat and recommends to remove as much DNAPLs as possible Based on the RI results, DNAPLs have been found in both shallow and deep wells close to the lagoons and canals EPA has signed Records of Decision to remediate the principal threats to the extent practicable EPA divides the Federal Creosote Site into operable units (OU) OU1 involves remediating source materials, i e , free-phase creosote, near the lagoons and canals, and OU2 involves remediating contaminated soil within Claremont Development The OU1 and OU2 remedies are designed to remove as much of the DNAPLs and contaminated soil as possible from the overburden The remediation involves excavating contaminated soil and removing free-phase creosote from the overburden down to the bedrock The excavation also involves dewatering the lagoon areas down to bedrock

6.2 ANALYSIS OF THE PERFORMANCE OF ONGOING OR COMPLETED REMEDIAL ACTIONS

EPA is currently excavating Lagoon B and is expected to remediate Lagoon A in 2002 EPA will also begin to remediate contaminated soil within Claremont Development in 2002 The total quantity of creosote waste and contaminated soil to be removed is estimated to be 43,900 cubic yards and 78,000 cubic yards, respectively The dewatering at Lagoon B will surround the lagoon and will be pumping at approximately 350 gpm for a period of time Assuming a dewatering period of two months, approximately 30 million gallons of water will be removed, which equates to approximately eight pore volumes of the dissolved plume at Lagoon B (see Figure 1-9 of the FS report for approximate plume dimensions). The dewatering design at Lagoon A has not been completed but is assumed to be similar to Lagoon B If that is the case, then four pore volumes of the dissolved plume at Lagoon A will be removed

At the completion of the OU1 and OU2 remedies, the amount of free-phase creosote and contaminated soil currently detected near Lagoons A and B in the overburden will be substantially removed Additionally, the aqueous plume now detected in the overburden aquifer will be pumped out during the dewatering process As a result, the contamination remaining in the groundwater (OU3) will include any residual DNAPLs in the weathered bedrock layer at the top of the bedrock, and DNAPLs and contaminant plumes in the fractured bedrock Therefore, the quantity of contaminants and the areal extent will be much smaller at the completion of OU1 and OU2 remedies than currently found.

EPA has proposed long-term monitoring and institutional controls as the remedy for groundwater at the site The long-term monitoring would include a network of monitoring wells that surround the existing contamination plumes New monitoring wells are also proposed to supplement the existing monitoring well network Additional monitoring wells could be installed if the site conditions change As the RI results reveal, dissolved contaminant plumes are observed downgradient of the two lagoons As depicted in Table 2-5 of the FS report, most of the contaminants detected are low molecular weight compounds, high molecular weight PAHs are detected infrequently and only slightly above the PRGs The creosote was released into the environment several decades ago and the contaminant plumes have not migrated far from the lagoons As discussed in Section 4 above, the contaminant migration has been effectively controlled by several factors The low molecular weight PAHs are being biodegraded when dissolved in groundwater, while the high molecular weight PAHs have low solubilities and extremely high retardation factors, thus preventing the migration of such contaminants

The groundwater at the site is not being used and the institutional controls would prevent future exposure to the contaminated groundwater Several municipal wells are currently pumping groundwater about half a mile from the site However, the RI results reveal that there is a groundwater divide between the municipal wells and the site As a result, the groundwater at the site is flowing southeast towards the Millstone River away from the municipal wells There is no indication this condition would change The sentinel wells installed under the remedy would provide an indication of changes to the groundwater conditions

6.3 PREDICTIVE ANALYSES OF TIME FRAMES TO ATTAIN CLEANUP LEVELS USING AVAILABLE TECHNOLOGIES

It is expected that it would take a very long time for the site groundwater to attain the cleanup levels, considering the low solubilities and extremely high retardation factors for the high molecular weight PAHs For example, benzo (a) pyrene, one of the most toxic compounds, has a solubility of 0 0039 mg/L, a Koc of 1,000,000, and a retardation factor of 4,500 The high Koc indicates that benzo (a) pyrene will tend to attach to soil particles instead of dissolving in groundwater The retardation factor implies that groundwater would have to travel 4,500 feet for the contaminant to travel a foot The groundwater velocity in the bedrock aquifer at the site is estimated at 160 feet per year, therefore it will take 28 years for benzo (a) pyrene to travel one foot However, it would be comparatively faster for the low molecular weight compounds, e g , naphthalene, to attain the groundwater cleanup levels Naphthalene has a solubility of 30 mg/L, a Koc of 1,300, and a retardation factor of 7 Therefore naphthalene will dissolve in and migrate with groundwater Any dissolved naphthalene will be subjected to biodegradation. The biodegradation half-life is short, ranging from days to a few months

Since the quantity of contaminants released to the environment is not known, it is not feasible to predict the time frame to attain the cleanup levels

6.4 DEMONSTRATION THAT NO OTHER REMEDIAL TECHNOLOGIES COULD RELIABLY, LOGICALLY, OR FEASIBLY ATTAIN THE CLEANUP LEVELS AT THE SITE WITHIN REASONABLE TIMEFRAME

The remedial experiences at other Superfund sites have shown that complete removal of DNAPLs from the subsurface is often not practicable Furthermore, no treatment technologies are currently available which can attain, with certainty, ARARs or risk-based cleanup levels where subsurface DNAPLs are present (EPA, 1996b) EPA guidance (EPA, 1993) lists factors that affect groundwater restoration The factors include site use, chemical properties, contaminant distribution, geology, and hydraulics/flow The factors were ranked from easy to difficult based on site conditions The Federal Creosote Site has been determined to be in the "difficult" category in all applicable factors (see Figure 2) According to the EPA guidance document titled "Pump-and-Treat Groundwater Remediation - A Guide for Decision Makers and Practitioners" (EPA, 1996a), the Federal Creosote Site would fall into the Class C category, which includes sites having fractured bedrock aquifers contaminated with DNAPLs The document suggests that such sites would be technically impractical to remediate For this reason, it is expected that an ARAR waiver due to technical impracticability would be appropriate for portions of the Federal Creosote Site where non-recoverable DNAPLs are present

The FS report has identified and screened multiple technologies Several technologies were deemed to be potentially effective and were retained to form into alternatives for further evaluations The technologies retained include conventional technologies, i e , long-term monitoring, institutional controls, containment and pumping and extraction, and innovative technologies, i e , in-situ oxidation and enhanced extraction using steam Six alternatives were formed and were evaluated in detail in Section 6 2 of the FS report The FS report demonstrated that these alternatives using the aforementioned technologies would not be able to attain the cleanup levels effectively and reliably within a reasonable time frame because of the site specific conditions, i e , fractured bedrock, DNAPLs, low solubilities, high retardation factors, and deep contamination, among other factors The rationales are summarized below

- Alternative 1 is No Action It is expected that the cleanup levels would not be attained because the presence of DNAPLs The dissolved plume, which consists mostly of naphthalene, will gradually biodegrade However, the DNAPLs, which consist of low and high molecular weight PAHs, will act as sources of the plumes The dissolved plume will continue to exist until low molecular weight PAHs are completely depleted from the DNAPLs
- Alternative 2 is Long-term Monitoring and Institutional Controls This alternative would not actively remediate the groundwater, therefore, it is expected that the alternative would not attain the cleanup level within a reasonable time frame because of the presence of DNAPLs, which will continue to act as sources of groundwater contamination
- Alternative 3 is Containment/Long-term Monitoring/Institutional Controls Similar to Alternative 2, this alternative would not actively remediate the groundwater but rather contain the contamination The contamination would continue to exceed ARARs within the containment areas because of the presence of the DNAPLs Implementation of this alternative could create significant inconvenience to the community during construction of the vertical barriers There would be a temporary negative impact on the commercial business and the residences located near the proposed wall during construction
- Alternative 4 involves in-situ treatment of the DNAPLs However, it is expected that 1 it would not be feasible to locate every pool of DNAPL for treatment, 2 There are areas underneath the railroad that would not be accessible for the in-situ treatment, 3 The treatment would likely leave residual contaminants that would act as contamination sources, 4 Installation and operation of the in-situ oxidation system and construction of

the vertical barriers would have significant impact to the community Therefore this technology would not be considered reliable to attain the cleanup levels at the site

- Alternative 5 involves conventional pumping and ex-situ treatment Due to the low solubility and high retardation factors of the high molecular weight PAHs, it would take many years to remove the contaminants Additionally, the extraction wells must intercept the fractures where contaminants reside for the extraction to be effective Therefore, this technology would not be considered reliable nor feasible to attain the cleanup levels at the site within a reasonable time frame
- Alternative 6 involves enhanced extraction using steam This technology has been demonstrated to be effective for removing contamination in soil but has not been tested for fractured bedrock, which has vastly different characteristics Installation of the steam injection/extraction wells and groundwater treatment system would have significant impact to the community This alternative would pose significant inconvenience and interruption to the community by the presence of equipment/piping and operation of the system in the neighboring properties Quality of live for the nearby residents would be greatly affected for several years The enhanced extraction alternative would also be inordinately costly at $78 million, which is almost six times higher than the next highest cost treatment alternative Therefore this alternative would not be considered reliable nor logical to attain the cleanup levels at this site

6.5 ESTIMATE OF COST OF PROPOSED REMEDY

The cost estimates for the six alternatives are depicted in Table 6-1 of the FS report and are summarized below

Alternative	Capital Costs	Annual O&M Costs (30 years)	Total Present Worth
1	0	0	0
2	$133,180	$1 million	$1 2 million
3	$13 million	$1 million	$14 1 million
4	$6 4 million	$1 million	$7 5 million
5	$2 8 million	$6 1 million	$8 9 million
6	$28 2 million	$48 8 million	$77 3 million

References

CDM Federal Programs Corporation, 2001a Draft Final Rustic Mall Focused Feasibility Study, Federal Creosote, Manville, New Jersey June 2001

United States Environmental Protection Agency 1993 Guidance for Evaluating the Technical Impracticability of Groundwater Restoration Directive 9234 2-25 September 1993

United States Environmental Protection Agency 1996a. Pump-and-Treat Groundwater Remediation - A Guide for Decision Makers and Practitioners EPA/625/R-95/005 July 1996

United States Environmental Protection Agency 1996b Presumptive Response Strategy and Ex-situ Treatment Technologies for Contaminated Ground Water At CERCLA Sites, Final Guidance EPA 540/R-96/023 October 1996

401135

401136

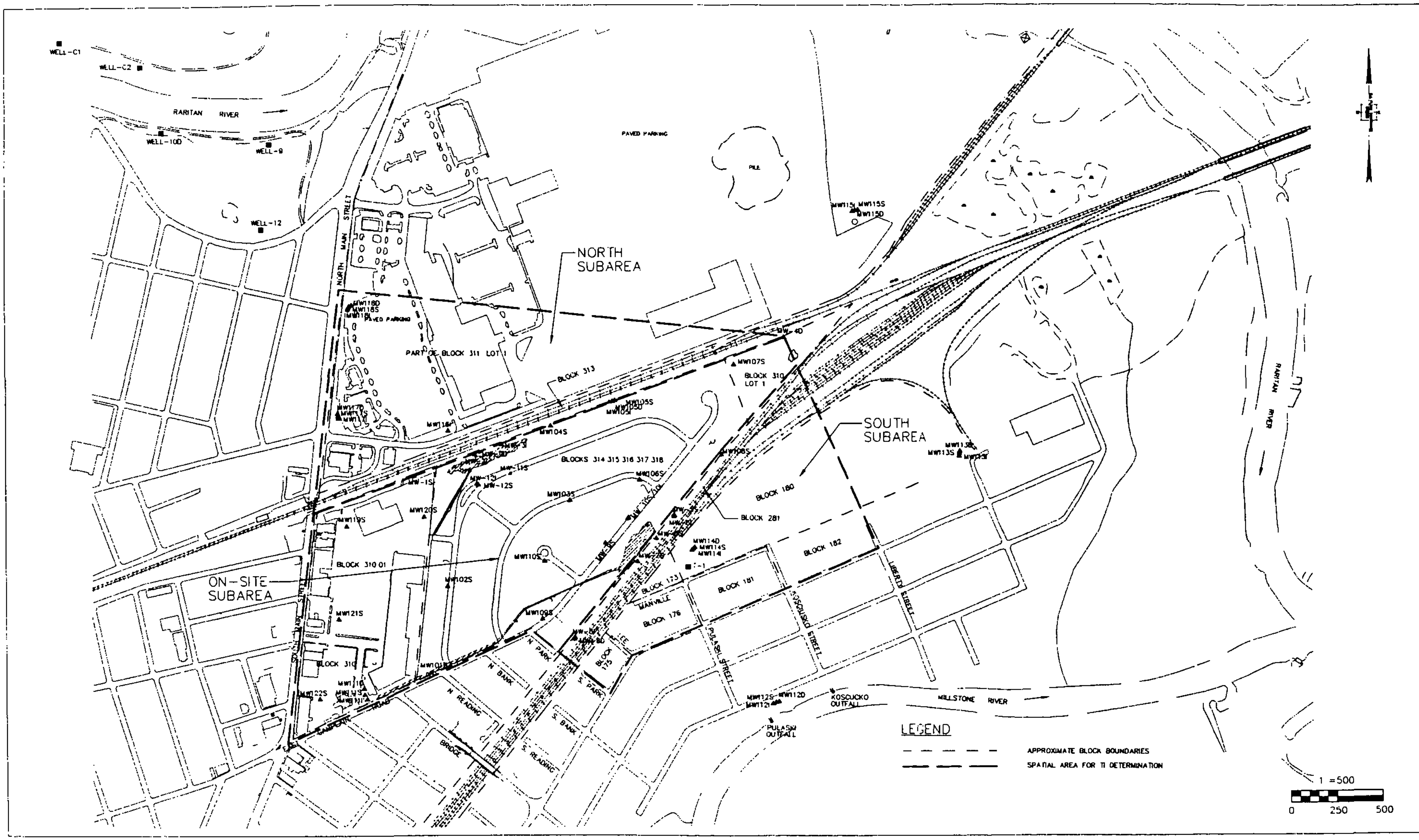


FIGURE 1

FEDERAL CREOSOTE SUPERFUND SITE
MANVILLE NEW JERSEY

SPATIAL AREA FOR TECHNICAL IMPRACTICABLITY DETERMINATION
JUNE 2002

CDM

Figure 2 Examples of Factors Affecting Ground-Water Restoration Potential

Certain site characteristics may limit the effectiveness of subsurface remediation The examples listed below are highly generalized The particular factor or combination of factors that may critically limit restoration potential will be site specific (Figure 1 is taken from EPA, 1993b with minor modifications)

Site/Contaminant Characteristics		Generalized Remediation Difficulty Scale Increasing difficulty →
Site Use	Nature of Release	Small Volume Short Duration Slug Release → Large Volume Long Duration Continual Release
Chemical Properties	Biotic/Abiotic Decay Potential	High → Low
	Volatility	High → Low
	Contaminant Retardation (Sorption) Potential	Low → High
Contaminant Distribution	Contaminant Phase	Aqueous, Gaseous → Sorbed → LNAPLs → DNAPLs
	Volume of Contaminated Media	Small → Large
	Contaminant Depth	Shallow → Deep

Hydrogeologic Characteristics

Geology	Stratigraphy	Simple Geology, e g , Planar Bedding Strata → Complex Geology, ~~e g , interbedded~~ and Discontinuous
	Texture of Unconsolidated Deposits	Sand → Clay
	Degree of Heterogeneity	Homogeneous e g , well-sorted sand → Heterogeneous ~~e.g., interbedded sand and~~ silts, clays, fractured media, karst
Hydraulics/Flow	Hydraulic Conductivity of Aquifer	High (>10^{-2} cm/sec) → Low (< 10 cm/sec)
	Temporal Variation of Flow Regime	Little/None → High
	Vertical Flow	Little Component → Large Downward Flow

ATTACHMENTS

Table 2-5
Preliminary Remedial Goals (PRGs) for Groundwater
OU3 Feasibility Study
Federal Creosote Superfund Site
Manville NJ

Contaminant of Potential Concern	Federal Standards	New Jersey State Standards		Preliminary Remediation Goals (h) ug/L	Maximum Detected Concentrations ug/L	No of Samples exceeding PRGs
	Drinking Water (a) ug/L	Primary Drinking Water (b) ug/L	Groundwater Quality Standard Class IIA Groundwater (c) ug/L			
Groundwater (ug/L)						
VOCs						
Benzene	5	1	1	1	**68**	12
Toluene	1 000	1 000	1 000	1 000	67	0
Ethylbenzene	700	700	700	700	25	0
m+p-Xylene	10 000	1 000	1 000[d]	1 000	390	0
SVOCs						
Phenol	NA	NA	4 000	4 000	37	0
2-Methylphenol	NA	NA	100[e]	100	**150**	1
4-Methylphenol	NA	NA	100[e]	100	85	0
2 4-Dimethylphenol	NA	NA	100	100	**770**	4
Carbazole	NA	NA	100[e]	100	**780**	19
Dibenzofuran	NA	NA	100[e]	100	**430**	19
Noncarcinogenic PAHs						
Naphthalene	NA	NA	300[d]	300	**13 000**	20
2-Methylnaphthalene	NA	NA	100[e]	100	**860**	17
Acenaphthene	NA	NA	400	400	**570**	3
Acenaphthylene	NA	NA	100[e]	100	**160**	1
Fluorene	NA	NA	300	300	**350**	2
Anthracene	NA	NA	2 000	2 000	28	0
Fluoranthene	NA	NA	300	300	87	0
Pyrene	NA	NA	200	200	72	0
Phenanthrene	NA	NA	100[e]	100	**350**	16
Benzo (g,h I) Perylene	NA	NA	100[e]	100	1	0
Carcinogenic PAHs						
Benzo (a) Anthracene	NA	NA	0 05[f]	5[j]	**21**	3
Benzo (b) Fluoranthene	NA	NA	0 05[f]	5[j]	**9**	1
Benzo (k) Fluoranthene	NA	NA	0 5[f]	5[j]	**13**	1
Benzo (a) Pyrene	0 2	0 2	0 005[f]	5[j]	**11**	1
Indeno (1 2 3-cd) Pyrene	NA	NA	0 05[f]	5[j]	1	0
Dibenzo (a,h) Anthracene	NA	NA	0 005[f]	5[j]	ND	0
Chrysene	NA	6	5[f]	5[j]	**14**	1

Notes

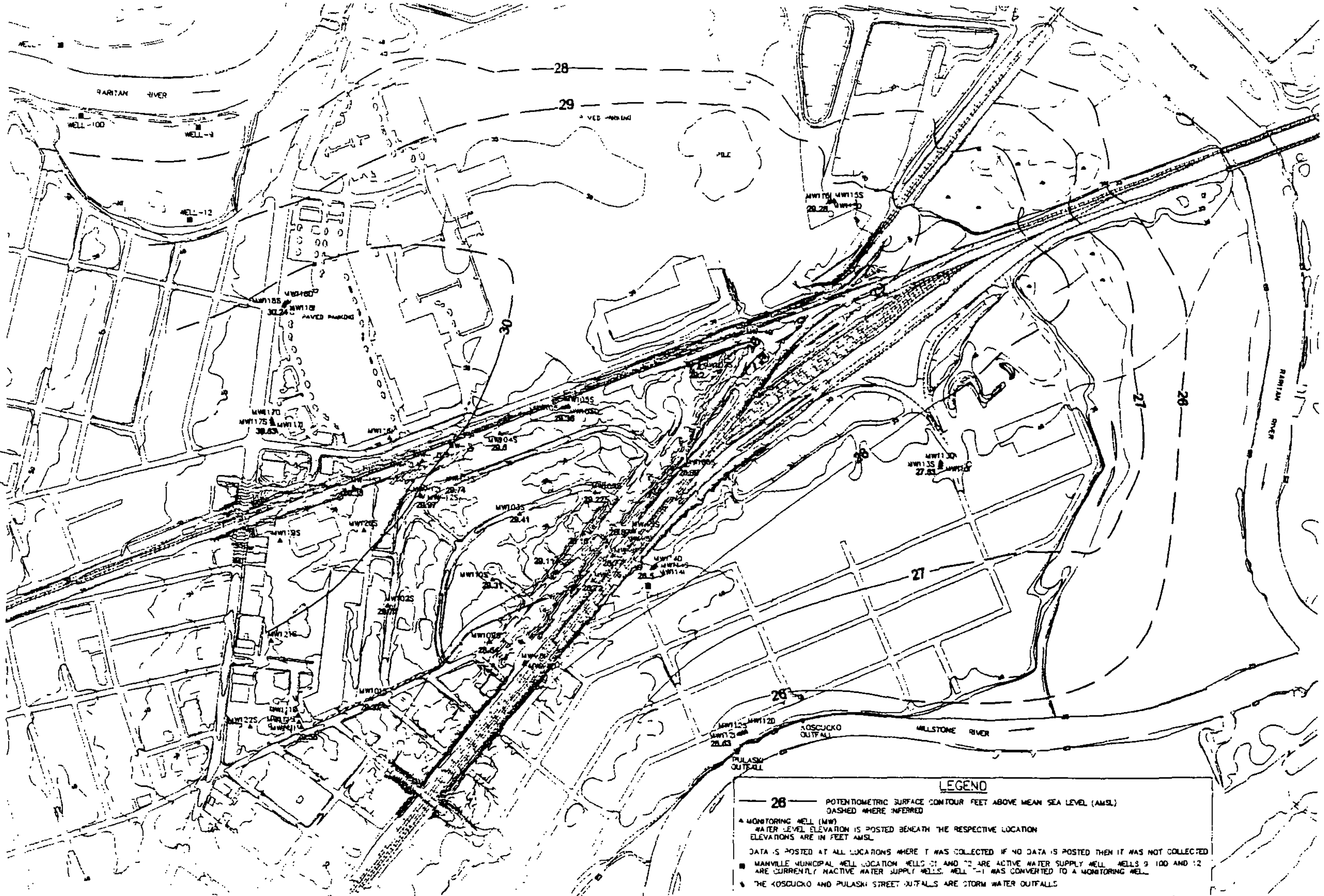
(a) National Primary Drinking Water Regulations Maximum Contamination Limits (MCLs) (40 CFR 141)
(b) New Jersey Safe Drinking Water Act (NJSDWA) Primary Drinking Water Standards (N J A C 7 10 et seq)
(c) New Jersey Safe Groundwater Quality Standards (N J A C 7 9-6) Table 1 - Specific Groundwater Quality Criteria - Class II-A and Practical Quantitation Levels (PQLs)
(d) An interim specific criteria based on Safe Drinking Water Act Maximum Contaminant Level (MCL)
(e) 100 ug/L default for non-carcinogenic synthetic organic chemical Interim non-carcinogenic generic criteria
(f) Interim specific criteria
(g) NA = Not Available
(h) PRGs for groundwater COPCs are the most stringent of the standards
(j) CLP Method Detection Limit, currently at 5 ug/L
Bold figures indicate detected concentrations exceed PRGs
ND Not detected

Table 6-1
Cost Estimate Summary
Federal Creosote Feasibility Study

Item No	Item Description	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
CAPITAL COSTS							
Construction Costs							
1	Work Plans	0	35,300	35,300	-	35,300	
2	Mobilization/Demobilization	0	5,000	5,000	50,000	5,000	
3	Health and Safety	0	8 900	8,900	8,900	8,900	
4	Monitoring Well Installation		66 280	66,280	66 280		
5	Deed Restrictions		17,700	17,700	17,700	17,700	17,700
6	Grout Curtain Wall Construction			9 527,500			
7	Pilot Study				200,000		2,000,000
8	In-situ Oxidation Injection				4,251,657		
9	Water Treatment Facility Construction					1,604,421	2 750 000
10	Extraction and Monitoring Well Installation					171,140	
11	Wellfield Construction						12,377 000
12	Start-up						2 678,650
	SUBTOTAL CONSTRUCTION COSTS	0	133,180	9,660 680	4,594,537	1,842,461	19 823,350
	Design Engineering			483,034	459,454	368,492	1,885 000
	Resident Engineering/Inspection			966,068	459,454	184,246	2,170,835
	Contingency (20%)			1,932,136	918,907	368,492	4,341 670
	TOTAL CAPITAL COSTS	0	133,180	13,041,918	6,432,352	2,763,691	28,220 855
ANNUAL O&M COSTS							
13	Project Planning and Organizing	0	1,700	1,700	1,700	1,700	1,700
14	Field Sampling Labor	0	24,300	24,300	24 300	29,700	24,300
15	Sampling Equipment, Shipping, Consumable Supplies	0	8,200	8,200	8,200	10,000	8 200
16	Sample Analysis and Data Validation	0	29,000	29 000	29,000	34,800	29 000
17	Data Evaluation and Reporting	0	16,800	16,800	16,800	16,800	16 800
18	Annual O&M (15 years duration)						5,357 300
19	Groundwater Treatment Plant O&M					396,450	
	Total Annual O&M Costs	0	80,000	80,000	80,000	489,450	5 437 300
FIVE YEAR REVIEW							
20	Five Year Review Report	0	35,300	35,300	35,300	35,300	35,300
PRESENT WORTH OF COSTS							
21	Total Capital Costs	0	133,180	13,041,918	6,432,352	2,763,691	28,220,855
22	Annual O&M Costs (30 year duration except Alternative 6 which is 15 year)	0	992,720	992,720	992,720	6,073,589	48 793 753
23	Five Year Review Costs (30 year duration)	0	76,171	76,171	76 171	76,171	264 088
	TOTAL PRESENT WORTH	0	1 202,071	14,110,809	7,501,243	8,913,451	77 298 958
	TOTAL PRESENT WORTH (ROUNDED)	0	**1,202,000**	**14,111,000**	**7,501,000**	**8,913,000**	**77,299,000**

24	Grout Curtain Wall (if required)				12,862,125		
	TOTAL PRESENT WORTH	0	1,202 071	14 110,809	20,363,125	8 913,000	77,299 000
	TOTAL PRESENT WORTH (ROUNDED)	0	**1,202,000**	**14,111,000**	**20,363,000**	**8,913,000**	**77,299,000**

401140



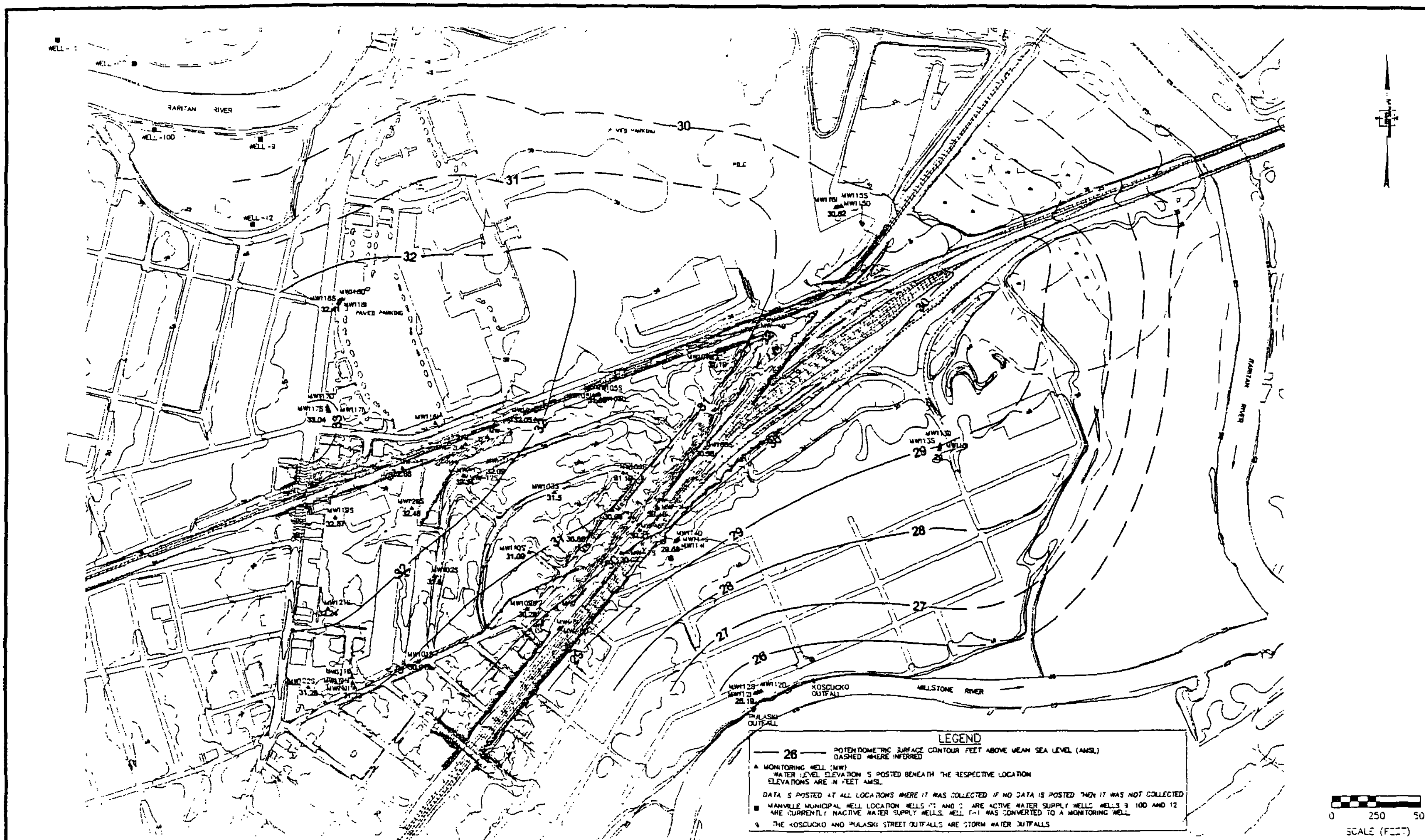
CDM FEDERAL PROGRAMS CORPORATION
a subsidiary of Camp Dresser & McKee Inc

FIGURE 1-7

OVERBURDEN POTENTIOMETRIC SURFACE MAP FOR APRIL 19 1999

FEDERAL CREOSOTE SUPERFUND SITE
MANVILLE NEW JERSEY
PROJECT NUMBER 3220-001

401142



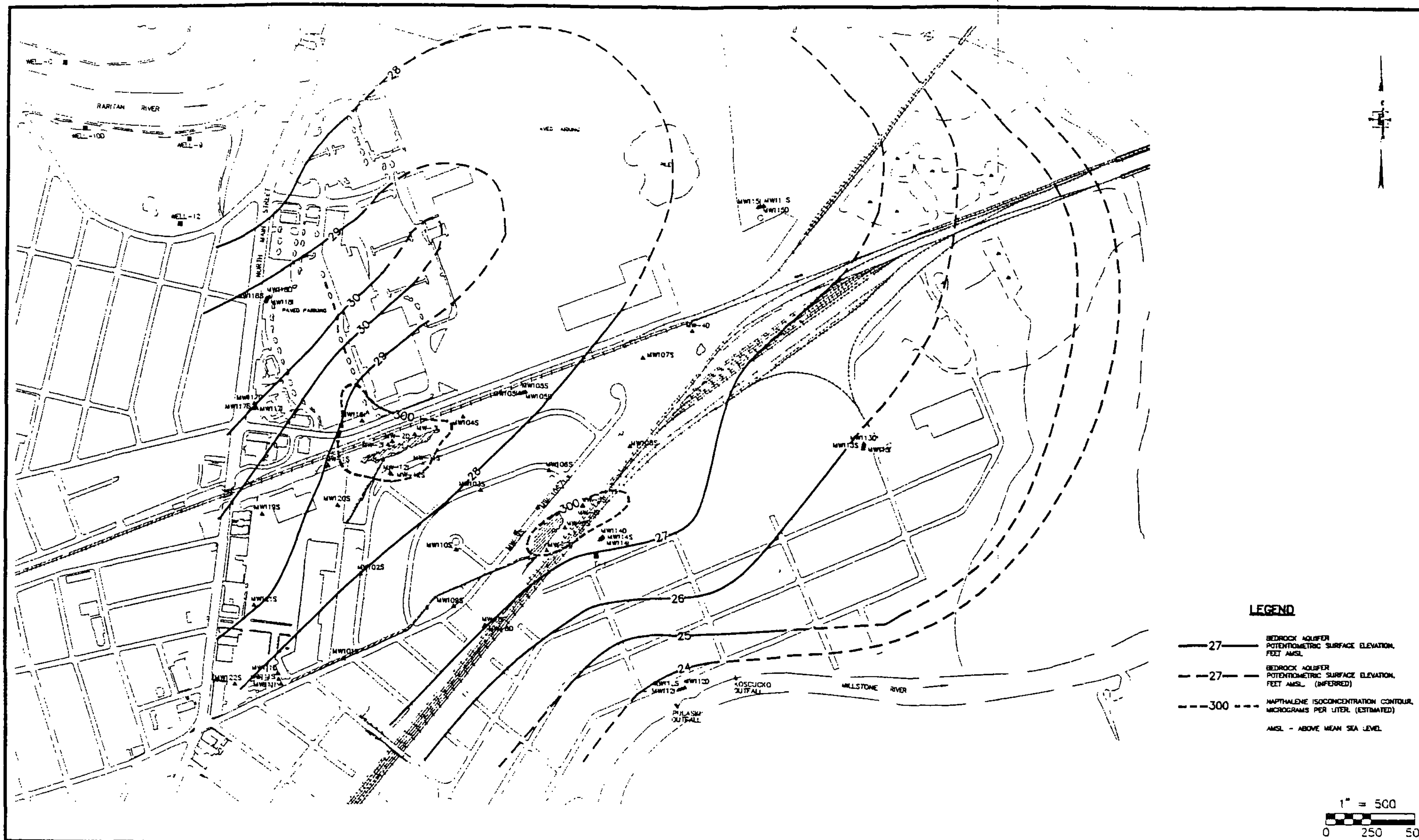
CDM FEDERAL PROGRAMS CORPORATION
a subsidiary of Camp Dresser & McKee Inc

FIGURE 1-8

OVERBURDEN POTENTIOMETRIC SURFACE MAP FOR NOVEMBER 1 1999

FEDERAL CREOSOTE SUPERFUND SITE
MANVILLE NEW JERSEY
PROJECT NUMBER 3220-001

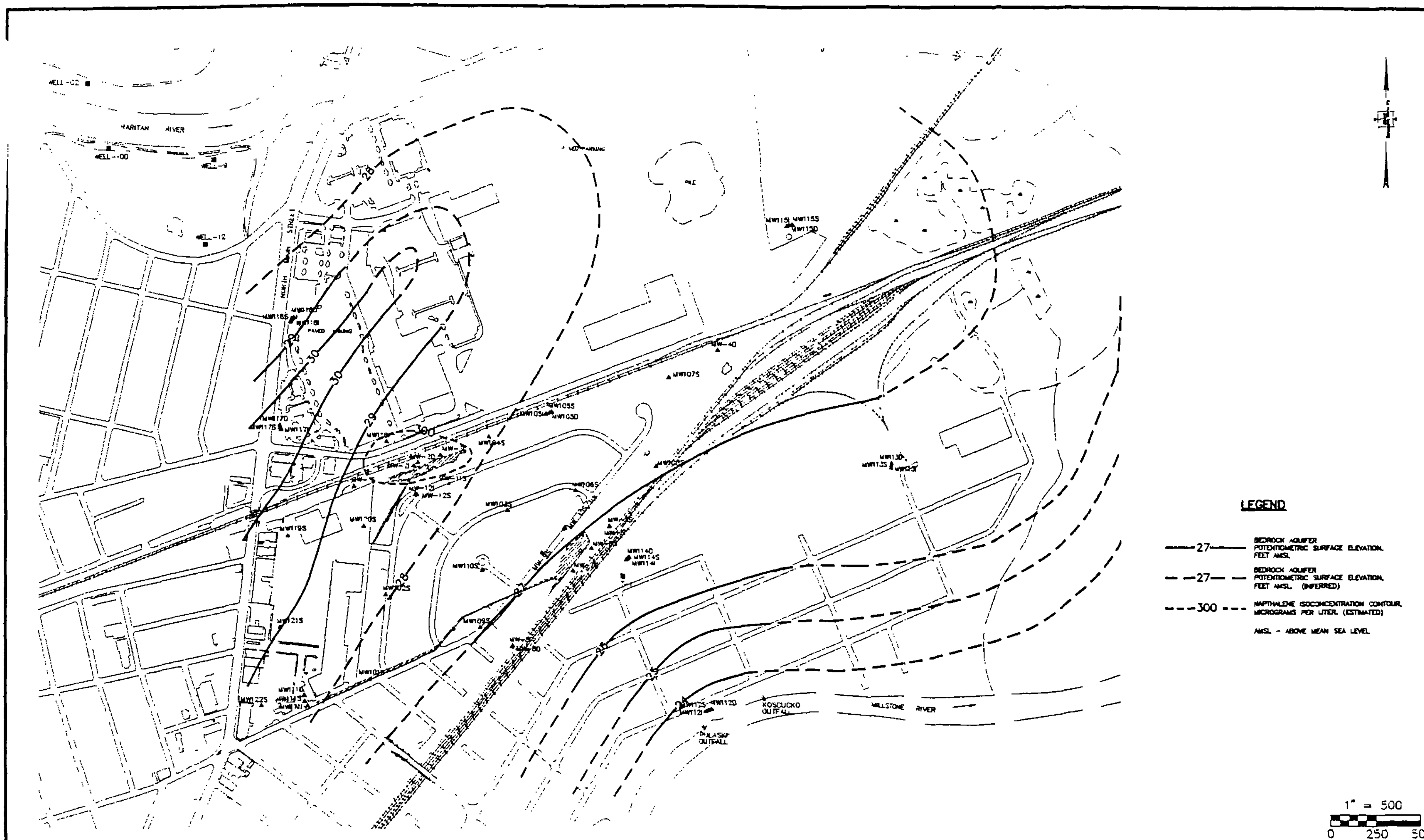
401143



CDM FEDERAL PROGRAMS CORPORATION
a subsidiary of Camp Dresser & McKee Inc

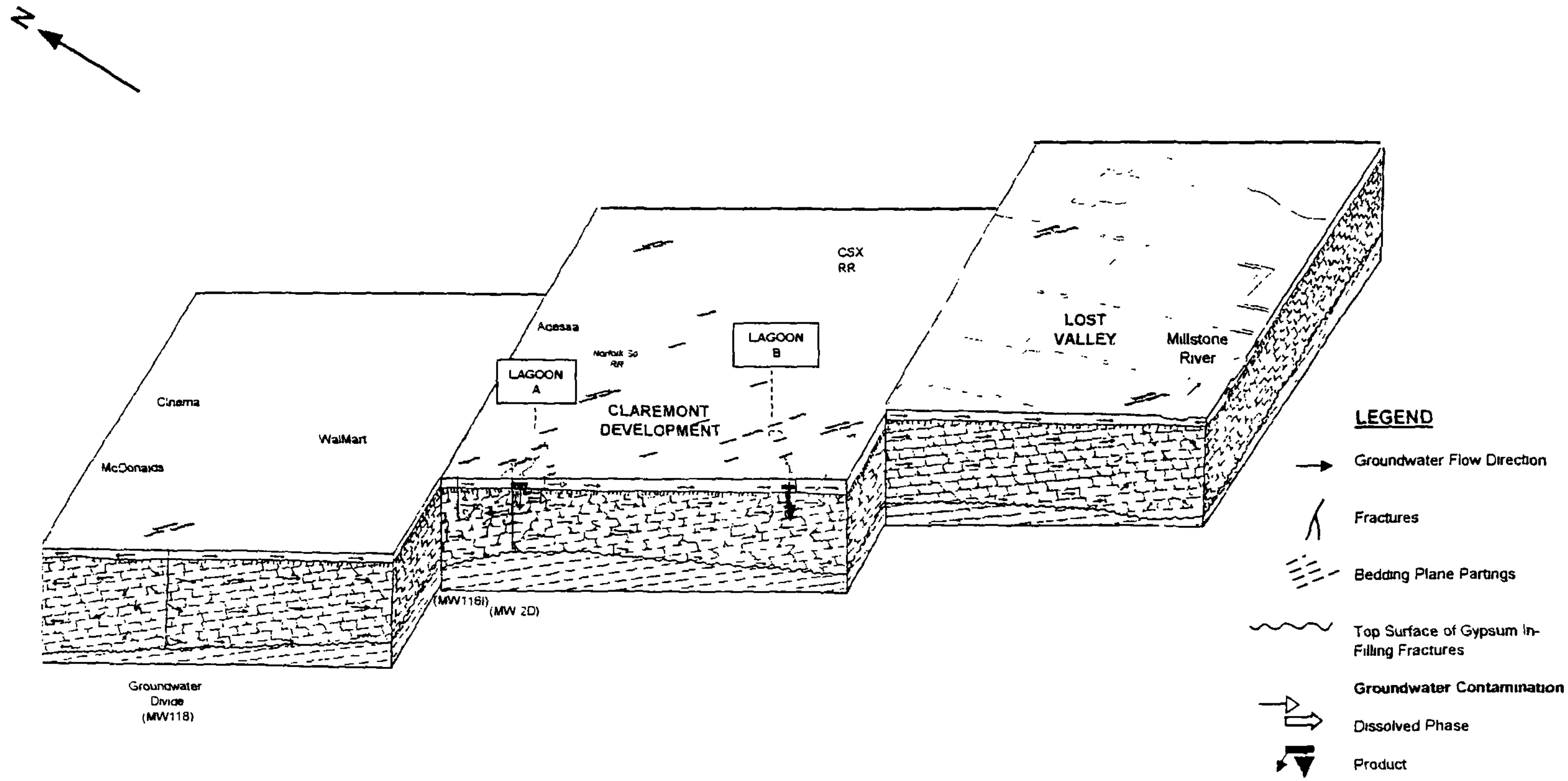
FIGURE 1-9
BEDROCK AQUIFER POTENTIOMETRIC SURFACE
ALTITUDE -10 FEET
JULY 19, 1999 DATA
FEDERAL CREOSOTE SUPERFUND SITE MANVILLE NEW JERSEY
PROJECT NUMBER 3220-001

401144



CDM FEDERAL PROGRAMS CORPORATION
a subsidiary of Camp Dresser & McKee Inc

FIGURE 1-10
BEDROCK AQUIFER POTENTIOMETRIC SURFACE
ALTITUDE -120 FEET
JULY 19, 1999 DATA
FEDERAL CREOSOTE SUPERFUND SITE MANVILLE NEW JERSEY
PROJECT NUMBER 3220-001



NOT TO SCALE

401145

CDM Federal Programs Corporation

a subsidiary of Camp Dresser & McKee

Figure 1-11

Site-Wide Conceptual Hydrogeologic Framework

Federal Creosote Superfund Site, Manville, New Jersey

Project Number 3220-001

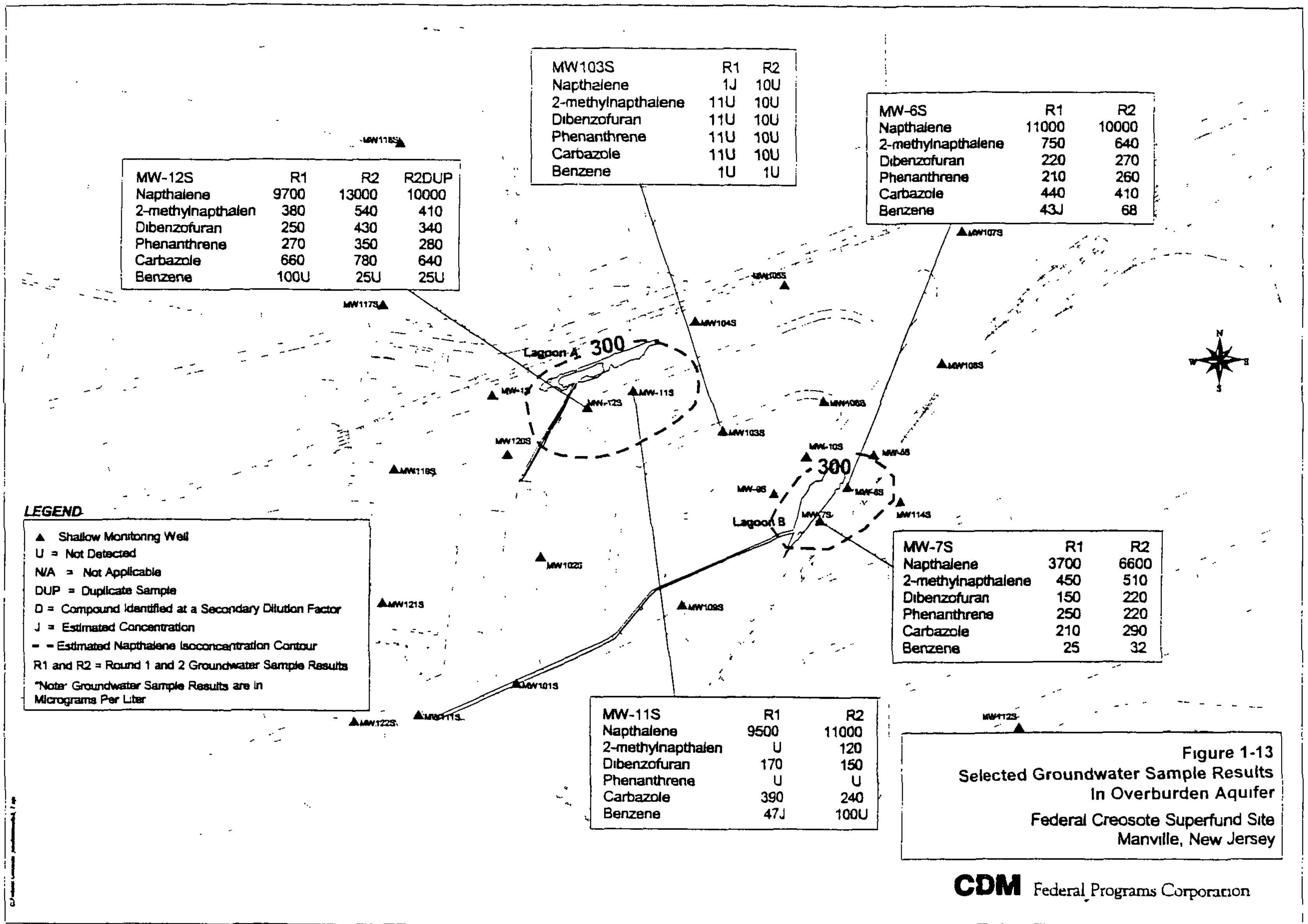
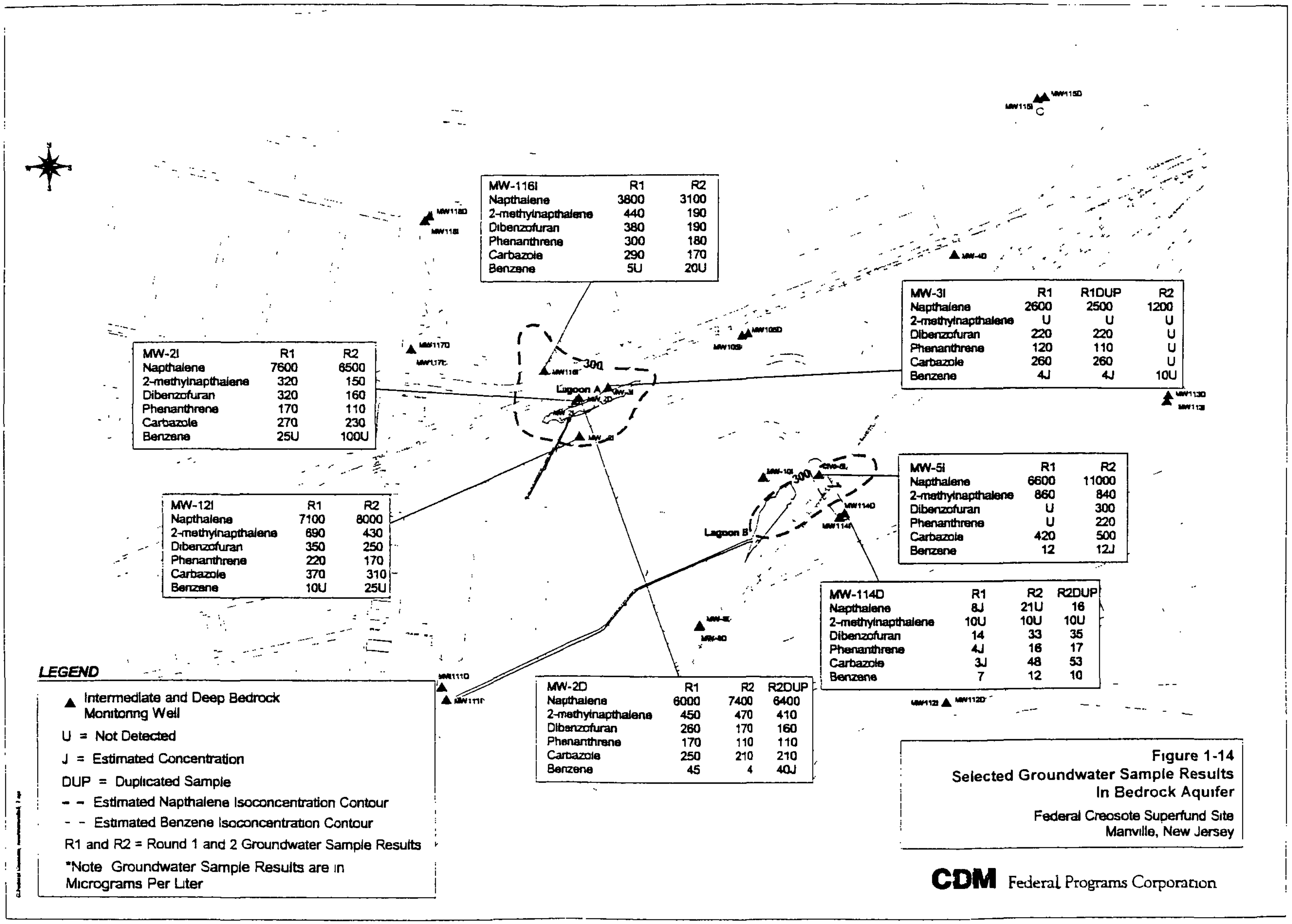


Figure 1-13
Selected Groundwater Sample Results
In Overburden Aquifer
Federal Creosote Superfund Site
Manville, New Jersey



MW-116I	R1	R2
Napthalene	3800	3100
2-methylnapthalene	440	190
Dibenzofuran	380	190
Phenanthrene	300	180
Carbazole	290	170
Benzene	5U	20U

MW-3I	R1	R1DUP	R2
Napthalene	2600	2500	1200
2-methylnapthalene	U	U	U
Dibenzofuran	220	220	U
Phenanthrene	120	110	U
Carbazole	260	260	U
Benzene	4J	4J	10U

MW-2I	R1	R2
Napthalene	7600	6500
2-methylnapthalene	320	150
Dibenzofuran	320	160
Phenanthrene	170	110
Carbazole	270	230
Benzene	25U	100U

MW-12I	R1	R2
Napthalene	7100	8000
2-methylnapthalene	690	430
Dibenzofuran	350	250
Phenanthrene	220	170
Carbazole	370	310
Benzene	10U	25U

MW-5I	R1	R2
Napthalene	6600	11000
2-methylnapthalene	860	840
Dibenzofuran	U	300
Phenanthrene	U	220
Carbazole	420	500
Benzene	12	12J

MW-114D	R1	R2	R2DUP
Napthalene	8J	21U	16
2-methylnapthalene	10U	10U	10U
Dibenzofuran	14	33	35
Phenanthrene	4J	16	17
Carbazole	3J	48	53
Benzene	7	12	10

MW-2D	R1	R2	R2DUP
Napthalene	6000	7400	6400
2-methylnapthalene	450	470	410
Dibenzofuran	260	170	160
Phenanthrene	170	110	110
Carbazole	250	210	210
Benzene	45	4	40J

LEGEND

▲ Intermediate and Deep Bedrock Monitoring Well

U = Not Detected

J = Estimated Concentration

DUP = Duplicated Sample

- - Estimated Napthalene Isoconcentration Contour

- - Estimated Benzene Isoconcentration Contour

R1 and R2 = Round 1 and 2 Groundwater Sample Results

*Note Groundwater Sample Results are in Micrograms Per Liter

Figure 1-14
Selected Groundwater Sample Results
In Bedrock Aquifer

Federal Creosote Superfund Site
Manville, New Jersey

CDM Federal Programs Corporation

CDM

125 Maiden Lane, 5th Floor
New York, NY 10038
(212) 785-9123

401148